In the claims:

1. (currently amended) A video-based animal behavior analysis system, comprising:

    a computer configured to determine a position and shape of an animal from video

    images and to characterize activity of said animal as one of a set of

    predetermined behaviors based on an analysis of changes in said position and

    said shape over time.

2. (original) The system of claim 1, further comprising:

    a video camera and a video digitization unit coupled to said computer for capturing

    said video images and converting said video images from analog to digital

    format.

3. (original) The system of claim 2, further comprising:

    an animal identification, segregation, and tracking module receiving said video

    images.

4. (original) The system of claim 3, wherein said computer further includes a behavior

identification module for characterizing activity of said animal, said behavior identification

module being coupled to said animal identification, segregation, and tracking module.

5. (original) The system of claim 4, wherein said computer further includes a standard

animal behavior storage module that stores information about known behavior of a

predetermined standard animal for comparing the activity of said animal, said standard

animal behavior storage module being coupled to said behavior identification module.

6. (original) The system of claim 1, wherein said animal is a mouse.

7. (original) The system of claim 1, wherein said animal is a rat.

8. (currently amended) A method of determining and characterizing activity of an

animal using computer processing of video images, comprising the steps of:

 detecting an animal in said video images;

 tracking changes ~~to~~ in position and shape of said animal over a plurality of said video

  images;

 ~~identifying and~~ classifying said changes ~~to~~ in position and shape of said animal as

  postures; and

 characterizing ~~said~~ activity of said animal as one of a set of predetermined behaviors

  based on a comparison of a sequence of said postures to pre-trained models or

  rules of said set of predetermined behaviors ~~such activity~~.

9. (currently amended) The method of claim 8, wherein said step of characterizing ~~said~~

activity includes the steps of:

 describing ~~a~~ said sequence of said postures as behavior primitives; and

 aggregating said behavior primitives into actual behavior over a range of images~~;~~.

10.   (currently amended) The method of claim 9, wherein said step of characterizing ~~said~~

activity ~~by describing and aggregating behavior primitives~~ further includes the steps of:

    describing a set of conditions and rules required for characterizing said <u>activity</u>

        ~~activities~~; and

    matching and testing generated features to see if said condition and rules are

        satisfied~~;~~<u>.</u>

11.   (currently amended) ~~The method of claim 8, wherein said detecting an animal~~

~~includes using a background subtraction method comprising the steps of:~~ <u>A method of</u>

<u>determining and characterizing activity of an animal using computer processing of video</u>

<u>images, comprising the steps of:</u>

    <u>detecting an animal in said video images;</u>

    <u>tracking changes to said animal over a plurality of video images;</u>

    <u>identifying and classifying said changes to said animal; and</u>

    <u>characterizing said activity of said animal based on a comparison to pre-trained</u>

        <u>models or rules of such activity, wherein the step of detecting an animal in</u>

        <u>said video images includes</u>

    apply<u>ing</u> a lenient threshold on a difference between a current image and a

        background so as to determine a broad region of interest;

    classify<u>ing</u> by intensity values various pixels in said region of interest to

        obtain said animal, by selecting only those intensity values that belong

        to <u>a</u> ~~the~~ set of model intensity values of <u>said</u> ~~the~~ animal; and

    refine<u>ing</u> contours of said animal image by smoothing.

12.   (currently amended)   The method of claim 8 ~~10~~, wherein said <u>step of classifying said</u>

<u>changes in position and shape of said animal as postures</u> ~~posture determination and~~

~~description~~ includes using statistical and contour-based shape information.

13.   (currently amended)   ~~The method of claim 12, wherein said step of identifying and~~

~~classifying changes to said animal includes using statistical shape information selected from~~

~~the group consisting of:~~ <u>A method of determining and characterizing activity of an animal</u>

<u>using computer processing of video images, comprising the steps of:</u>

     <u>detecting an animal in said video images;</u>

     <u>tracking changes to said animal over a plurality of video images;</u>

     <u>identifying and classifying said changes to said animal; and</u>

     <u>characterizing said activity of said animal based on a comparison to pre-trained</u>

          <u>models or rules of such activity,</u>

<u>wherein said step of characterizing said activity includes the steps of:</u>

     <u>describing a sequence of postures as behavior primitives;</u>

     <u>aggregating behavior primitives into actual behavior over a range of images;</u>

     <u>describing a set of conditions and rules required for characterizing said activities; and</u>

     <u>matching and testing generated features to see if said conditions and rules are</u>

          <u>satisfied;</u>

<u>wherein said posture determination and description includes using statistical and contour-</u>

<u>based shape information;</u>

<u>wherein said step of identifying and classifying changes to said animal includes using</u>

<u>statistical shape information selected from the group consisting of:</u>

     <u>area of</u> <u>said</u> ~~the~~ animal;

centroid position of <u>said</u> ~~the~~ animal;

bounding box and ~~its~~ aspect ratio <u>of said bounding box</u> of <u>said</u> ~~the~~ animal;

eccentricity of <u>said</u> ~~the~~ animal; and

directional orientation of <u>said</u> ~~the~~ animal relative to an axis as generated with a

Principal Component Analysis.

14.   (currently amended) The method of claim 12, wherein said step of ~~identifying and~~ classifying <u>said changes in position and shape of said animal as postures</u> ~~changes to said~~ ~~animal~~ uses contour-based shape information selected from the group consisting of curvature measures, thickness measures, relative orientation measures, length measures, and corner points.

15.   (currently amended) The method of claim 12, wherein said step of ~~identifying and~~ classifying <u>said changes in position and shape of said animal as postures</u> ~~changes to said~~ ~~animal~~ includes identifying a set of model postures and ~~their~~ description information <u>for said</u> <u>set of model postures</u>, said set of model postures including <u>a</u> horizontal side view posture, <u>a</u> vertical posture, <u>a</u> cuddled posture, <u>a</u> horizontal front/back view posture, <u>a</u> partially reared posture, <u>a</u> stretched posture, <u>a</u> hang vertical posture, <u>a</u> hang cuddled posture, <u>an</u> eating posture, and <u>a</u> drinking posture.

16.   (currently amended) The method of claim <u>12</u> ~~15~~, wherein said step of ~~identifying and~~ classifying <u>said changes in position and shape of said animal as postures</u> ~~changes to said~~ ~~animal~~ includes classifying the statistical and contour-based shape information from a current image to assign a best-matched posture.

17.   (currently amended) The method of claim 9 ~~10~~, wherein the said step of describing said sequence of said postures as ~~said~~ behavior primitives includes ~~the step of~~ identifying patterns of postures over a sequence of images.

18.   (currently amended) ~~The method of claim 17,~~ A method of determining and characterizing activity of an animal using computer processing of video images, comprising the steps of:

        detecting an animal in said video images;

        tracking changes to said animal over a plurality of video images;

        identifying and classifying said changes to said animal; and

        characterizing said activity of said animal based on a comparison to pre-trained

                models or rules of such activity,

wherein said step of characterizing said activity includes the steps of:

        describing a sequence of postures as behavior primitives;

        aggregating behavior primitives into actual behavior over a range of images;

        describing a set of conditions and rules required for characterizing said activities; and

        matching and testing generated features to see if said conditions and rules are

                satisfied;

wherein the said step of describing said behavior primitives includes the step of identifying patterns of postures over a sequence of images; and

wherein said step of describing said behavior primitives step further includes the step of analyzing temporal information selected from the group consisting of direction and magnitude of movement of the centroid, increase and decrease of the eccentricity, increase

and decrease of the area, increase and decrease of the aspect ratio of a ~~the~~ bounding box, and change in contour information.

19.   (currently amended) The method of claim 10, wherein the said step of ~~determining actual behavior by~~ aggregating said behavior primitives includes ~~the step of~~ analyzing temporal ordering of ~~the~~ said behavior primitives, such as using information about a transition from a previous behavior primitive to a next behavior primitive, and applying all applicable conditions and rules.

20.   (currently amended) The method of claim 19, wherein said <u>analyzing temporal ordering of said behavior primitives</u> ~~temporal analysis~~ is a time-series analysis such as Hidden Markov Model (HMM).

21.   (currently amended) The method of claim <u>8</u> ~~19~~, wherein ~~the~~ said ~~step of determining actual behavior includes identifying actual behavior selected from a group~~ <u>set of predetermined behaviors corresponds to a set</u> of pre-trained behavior models.

22.   (currently amended) The method of claim <u>8</u> ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ <u>set of predetermined behaviors includes</u> rearing up to a fully reared up or partially reared up position, ~~and said rearing behavior~~ <u>which</u> is determined by <u>a</u> ~~the~~ sequence of posture<u>s</u> starting from cuddled, horizontal side-view, or horizontal front/back view postures to ending in a vertical or partially reared posture~~;~~<u>.</u>

23.   (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes coming down from a reared up or partially reared up position, ~~and said come down behavior~~ which is determined by a ~~the~~ sequence of postures starting from vertical or partially reared postures to ending in a cuddled, horizontal side view or horizontal front/back view posture~~;~~.

24.   (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes eating, ~~and said eating behavior~~ which is determined by a sequence of eating postures where the mouth of said ~~the~~ animal is in touch with a food container~~;~~.

25.   (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes drinking, ~~and said drinking behavior~~ which is determined by a sequence of drinking postures where the mouth of said ~~the~~ animal is in touch with a water spout~~;~~.

26.   (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes digging, ~~and said digging behavior~~ which is determined by the aft movement of bedding by said ~~the~~ animal with its fore and hind limbs~~;~~.

27.   (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes foraging, ~~and said~~

~~foraging behavior~~ <u>which</u> is determined by the movement of bedding using the mouth and

forelimbs~~;~~<u>.</u>

28.   (currently amended) The method of claim <u>8</u> ~~21~~, wherein said ~~group of behavior~~

~~models includes the behavior of~~ <u>set of predetermined behaviors includes</u> jumping, ~~and said~~

~~jumping behavior~~ <u>which</u> is determined by a single up and down movement of <u>said</u> ~~the~~

animal~~;~~<u>.</u>

29.   (currently amended) The method of claim <u>8</u> ~~21~~, wherein said ~~group of behavior~~

~~models includes the behavior of~~ <u>set of predetermined behaviors includes</u> jumping repetitively

~~and said repetitive jumping behavior~~ <u>, which</u> is determined by several continuous up and

down movement of <u>said</u> ~~the~~ animal~~;~~<u>.</u>

30.   (currently amended) The method of claim <u>8</u> ~~21~~, wherein said ~~group of behavior~~

~~models includes the behavior of~~ <u>set of predetermined behaviors includes</u> sniffing, ~~and said~~

~~sniffing behavior~~ <u>which</u> is determined by random brisk movement of the head while the rest

of the body remains stationary~~;~~<u>.</u>

31.   (currently amended) The method of claim <u>8</u> ~~21~~, wherein said ~~group of behavior~~

~~models includes the behavior of~~ <u>set of predetermined behaviors includes</u> hanging from the

top of the cage, ~~and said hanging behavior~~ <u>which</u> is determined by a sequence of postures

starting from vertical posture to ending in a hang vertical or hang cuddled posture~~;~~<u>.</u>

32. (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes landing after hanging, ~~and said landing behavior~~ which is determined by a sequence of postures starting from a hang vertical or hang cuddled posture to ending in a vertical posture~~;~~.

33. (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes sleeping, ~~and said sleeping behavior~~ which is determined by the absence of major movements of the contour of said ~~the~~ animal for a prolonged period of time~~;~~.

34. (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes twitching during sleep, ~~and said twitch behavior~~ which is determined by ~~the~~ detection of a brief period of substantial movement and the_n_ resumption of sleep activity~~;~~.

35. (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes awakening from sleep, ~~and said awaken behavior~~ which is determined by a prolonged movement of said ~~the~~ animal after sleep has set in~~;~~.

36. (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes grooming, ~~and said grooming behavior~~ which is determined by brisk movement of limbs and mouth in a cyclical and periodic pattern~~;~~.

37.   (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes pausing briefly, ~~and said pause behavior~~ which is determined by brief absence of movement of said ~~the~~ animal~~;~~.

38.   (currently amended) The method of claim 8 ~~21~~, wherein said group of behavior models includes the behavior of urinating, and said urinate behavior is determined by the detection of the tail being raised up and the animal remaining stationary briefly~~;~~.

39.   (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes turning, ~~and said turn behavior~~ which is determined by a sequence of postures starting from horizontal side view or cuddled posture to ending in a horizontal front/back view posture, and vice versa~~;~~.

40.   (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes circling, ~~and said circling behavior~~ which is determined by ~~a 3~~ three or more successive turns~~;~~.

41.   (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes walking or running, ~~and said walking or running behavior~~ which is determined by the continuous sideways movement of the centroid of said ~~the~~ animal~~;~~.

42. (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes body stretching ~~its body~~ vertically or horizontally, ~~and said stretch behavior~~ which is determined by a concave shape of said ~~the~~ animal's back~~;~~.

43. (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes chewing, ~~and said chewing behavior~~ which is determined by the movement of the mouth while the mouth is not in touch with a food container~~;~~.

44. (currently amended) The method of claim 8 ~~21~~, wherein said ~~group of behavior models includes the behavior of~~ set of predetermined behaviors includes remaining stationary, ~~and said stationary behavior~~ which is determined by said ~~the~~ animal remaining in the same place and not performing any of the other predetermined behaviors~~;~~.

45. (currently amended) The method of claim 8 ~~21~~, wherein ~~if~~ said set of predetermined behaviors includes unknown behavior, which is ~~the~~ activity that cannot be characterized by any of a set of ~~the~~ behavior models~~, the behavior is deemed unknown;~~.

46. (currently amended) The method of claim 8, wherein said steps are ~~also~~ performed in night conditions by using red light to simulate such night conditions, or by using infra-red cameras to capture ~~the~~ images with no light~~;~~.

47.   (currently amended) The method of claim 8, wherein said steps are ~~also~~ performed

with a plurality of cages or arenas, each of which contains a single animal~~;~~.

48.   (currently amended) The method of claim 8, wherein said step of detecting <u>an</u> animal

includes ~~the step of~~ detecting body parts of <u>said</u> ~~the~~ animal~~;~~.

49.   (currently amended) The method of claim 48, wherein said body parts include the

head~~;~~.

50.   (currently amended) The method of claim 48, wherein said body parts include the

tail~~;~~.

51.   (currently amended) The method of claim 48, wherein said body parts include the

ear~~;~~.

52.   (currently amended) The method of claim 48, wherein said body parts include the

upper and lower back~~;~~.

53.   (currently amended) The method of claim 48, wherein said body parts include the

abdomen~~;~~.

54.   (currently amended) The method of claim 48, wherein said body parts include the

hind-limbs~~;~~.

55.   (currently amended) The method of claim 48, wherein said body parts include the

forelimbs;.